FloodRISE
Resilient Infrastructure & Sustainable Environments

Flood Resilient Infrastructure and Sustainable Environments (FloodRISE) Project

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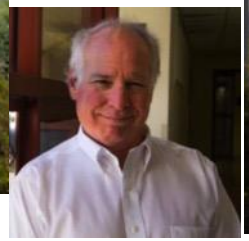
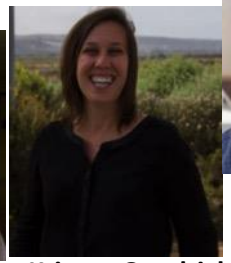

Dave Feldman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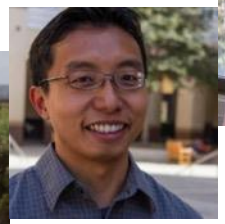
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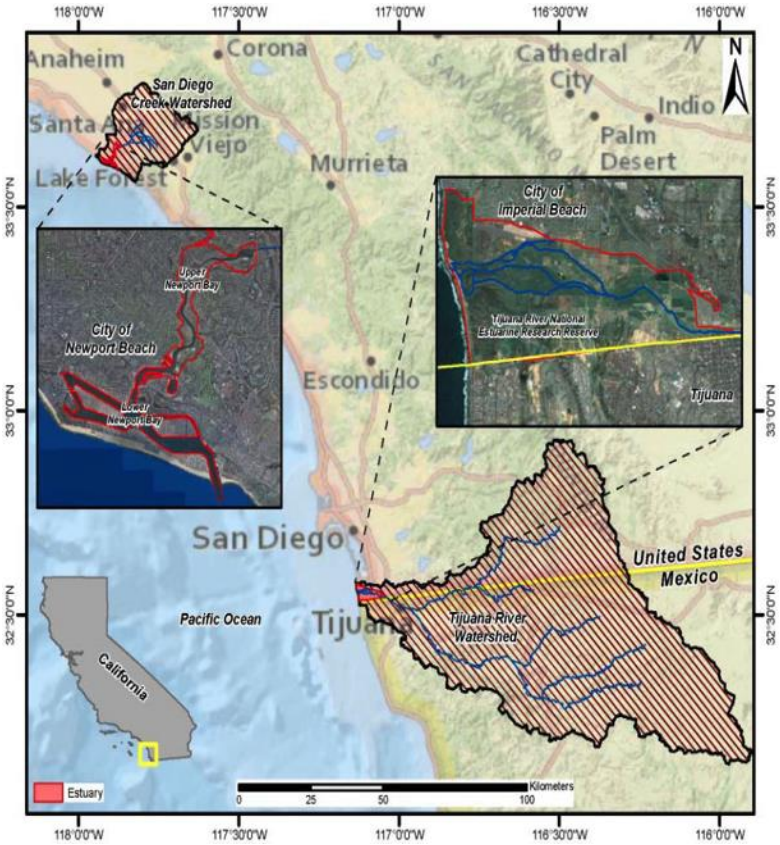
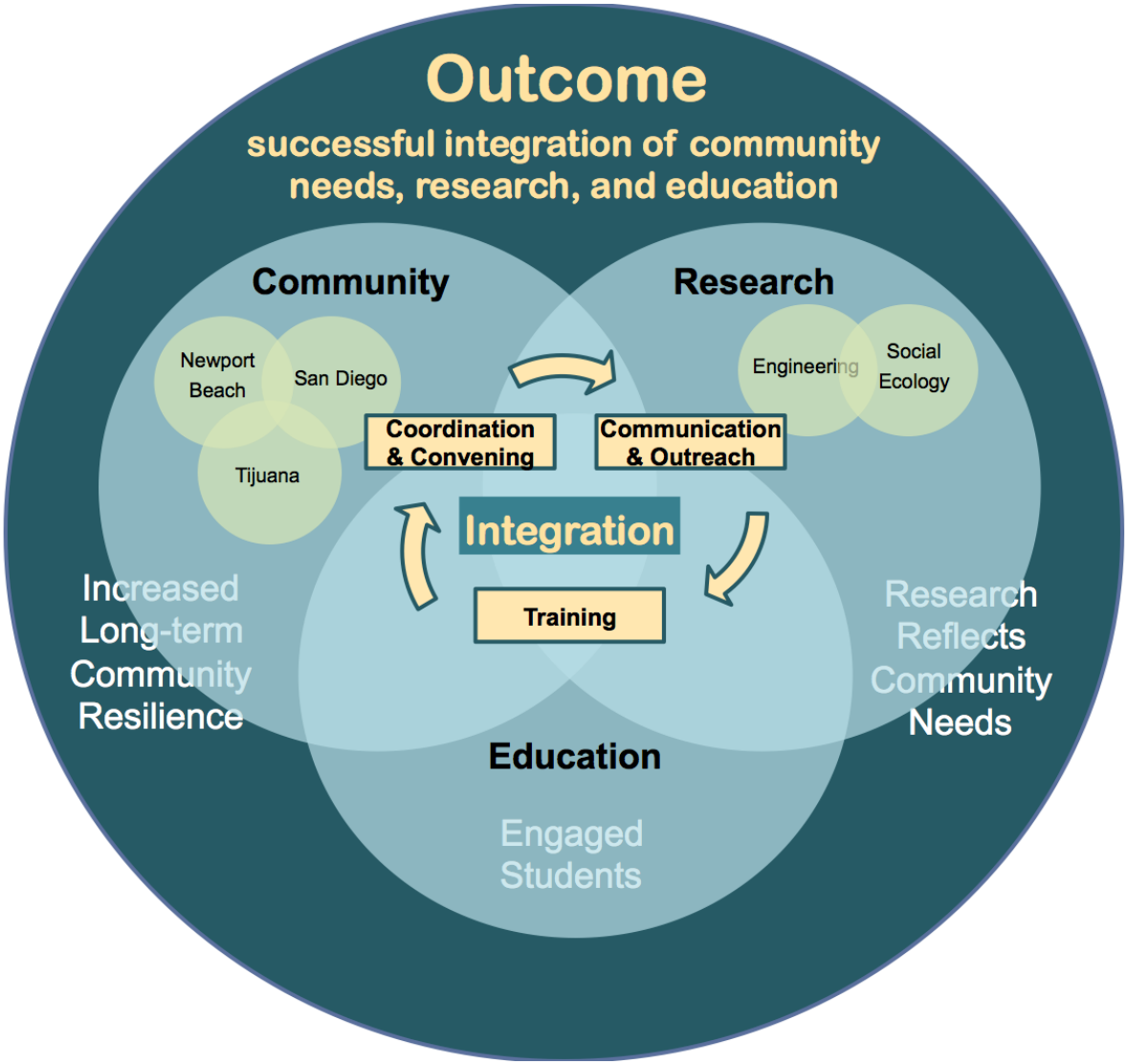
Overview

- Interdisciplinary project between Departments of Planning, Policy, and Design & Civil and Environmental Engineering at the University of California-Irvine
- Project intended to help improve **long-term resilience to flood hazards** at 2 sites, both adjacent to areas of high natural capital
  - **Tijuana River Valley** (U.S.) & **Los Laureles** (MX) (bi-national)
  - **Newport Beach**, CA



An integrated and community-driven approach



What are we doing?

1st : **Household surveys and interviews** to assess experiences with flooding, and – through a mapping exercise – residents' perceptions of where floods have occurred/might occur in future.

2nd : **Focus groups** comprised of a broad cross-section of community leaders, to determine what visual information is useful and useable – and what features maps should have to help communities becomes more resilient against floods.

3rd: **Communication strategies** for affected communities using information acquired throughout the process.

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Why are we doing this?

- Flooding is a significant hazard in coastal communities in terms of potential losses of property, lives, and livelihoods.
- While causes vary, and consequences are wide-ranging – coastal areas are especially vulnerable due to:
  - *Climate variability/sea-level rise*
  - *People living along flood plains and low-lying areas*
  - *The sudden onset of heavy rains*

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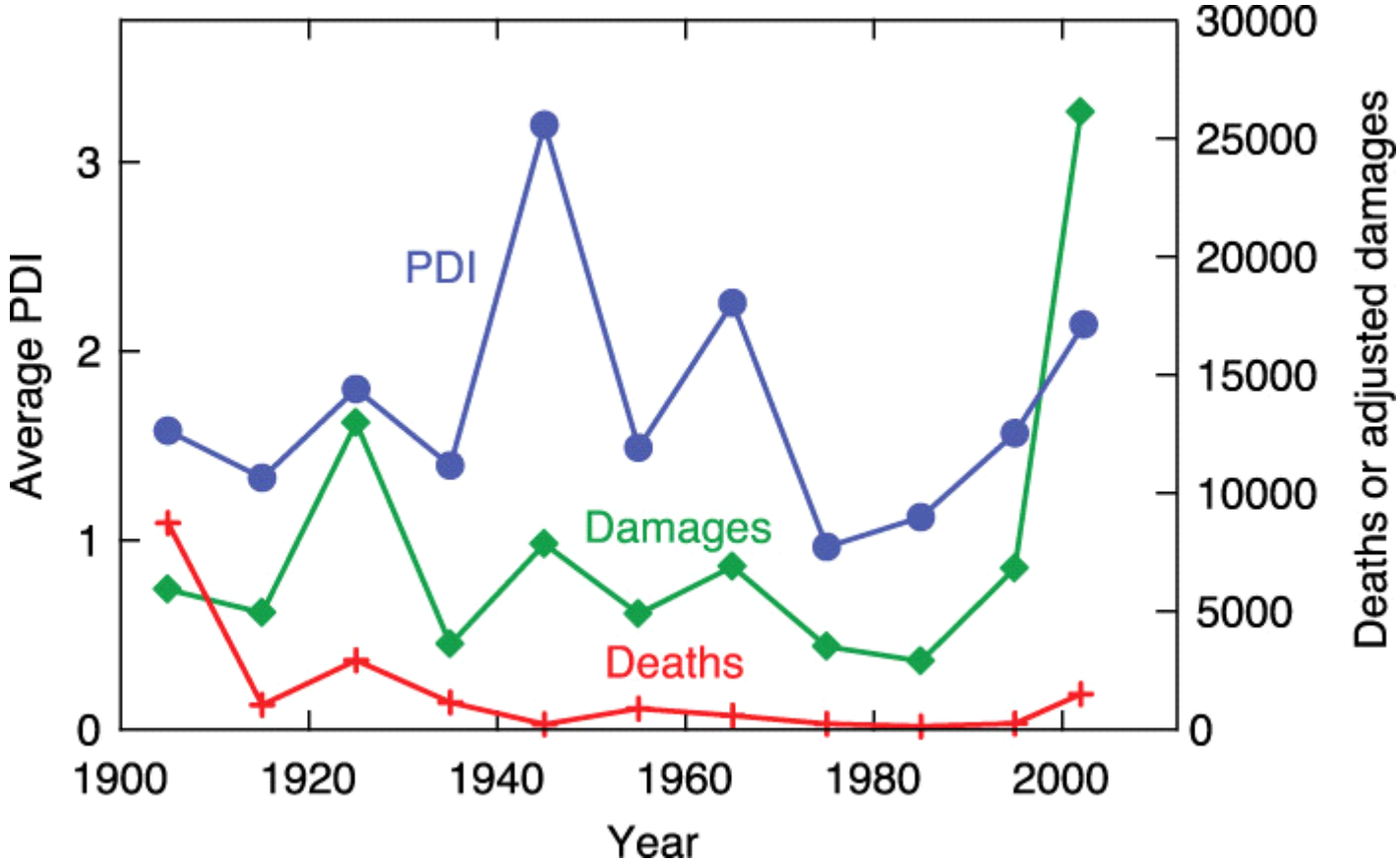
Why are coastal floods a concern?



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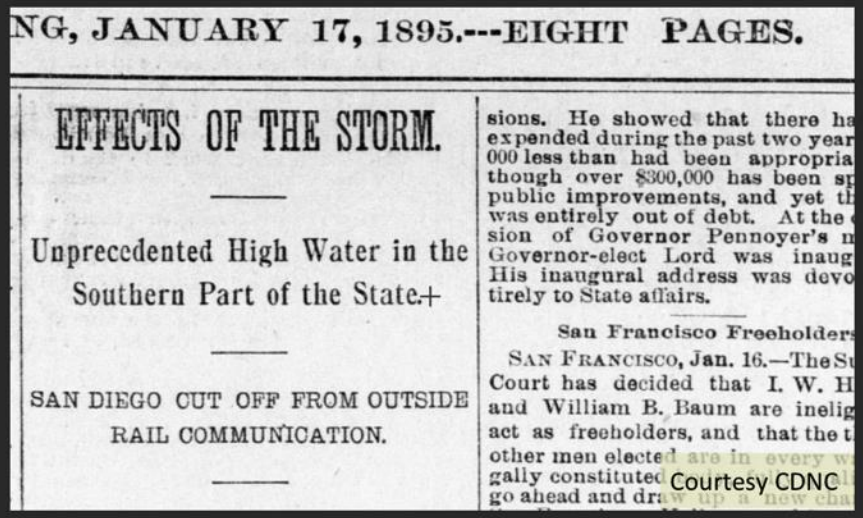
Textual accounts (1769-2014)



NG, JANUARY 17, 1895.---EIGHT PAGES.

EFFECTS OF THE STORM.

Unprecedented High Water in the Southern Part of the State.+

SAN DIEGO CUT OFF FROM OUTSIDE RAIL COMMUNICATION.

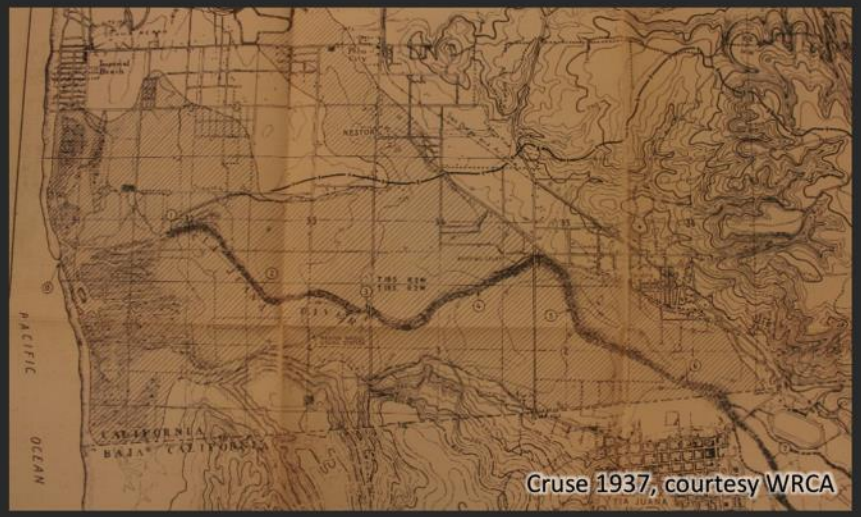
sions. He showed that there ha
expended during the past two year
000 less than had been appropria
though over $300,000 has been sp
public improvements, and yet th
was entirely out of debt. At the
sion of Governor Pennoyer's n
Governor-elect Lord was inaug
His inaugural address was devo
tirely to State affairs.

San Francisco Freeholders

SAN FRANCISCO, Jan. 16.—The Su
Court has decided that I. W. H
and William B. Baum are inelig
act as freeholders, and that the t
other men elected are in every w
gally constituted
go ahead and draw up a new cha

Courtesy CDNC

Flood maps (1937, 1963)

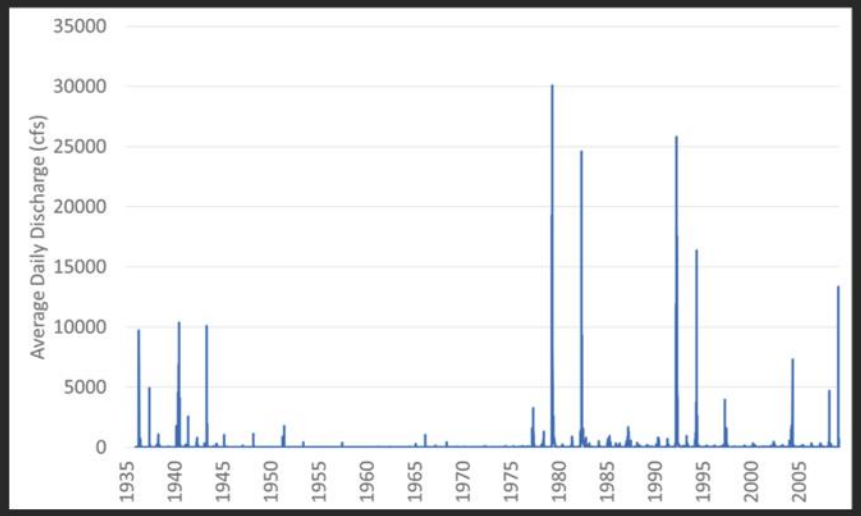


Cruse 1937, courtesy WRCA

Landscape/aerial photos (earliest ca. 1890)

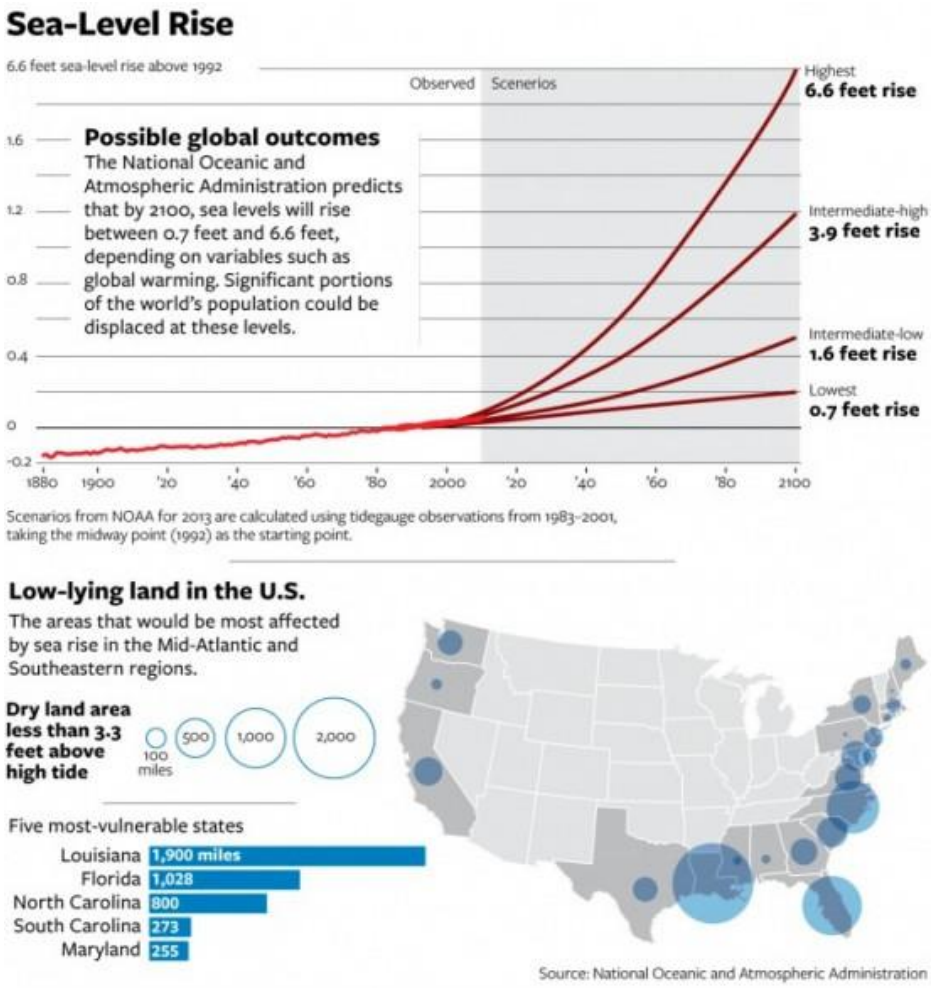
1918, courtesy SDHC

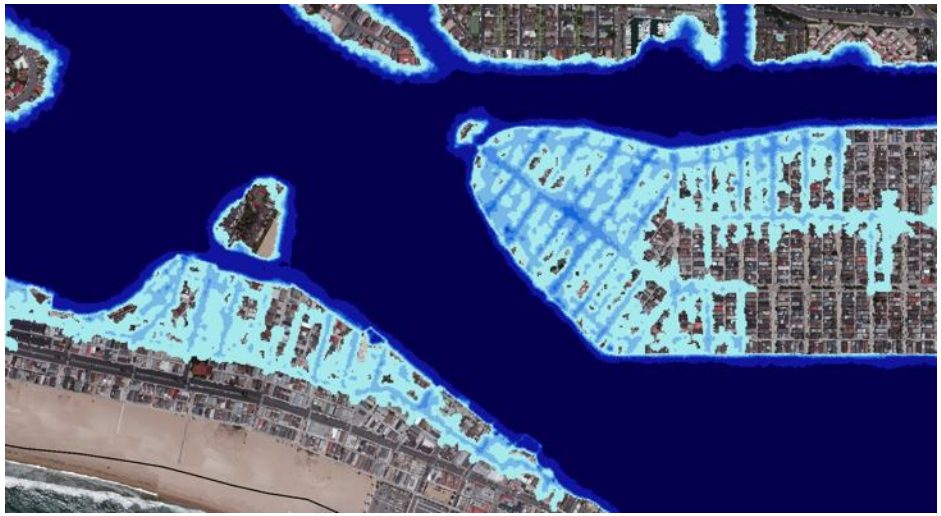
Gage data (1914-2009)



Slide courtesy of San Francisco Estuary Institute

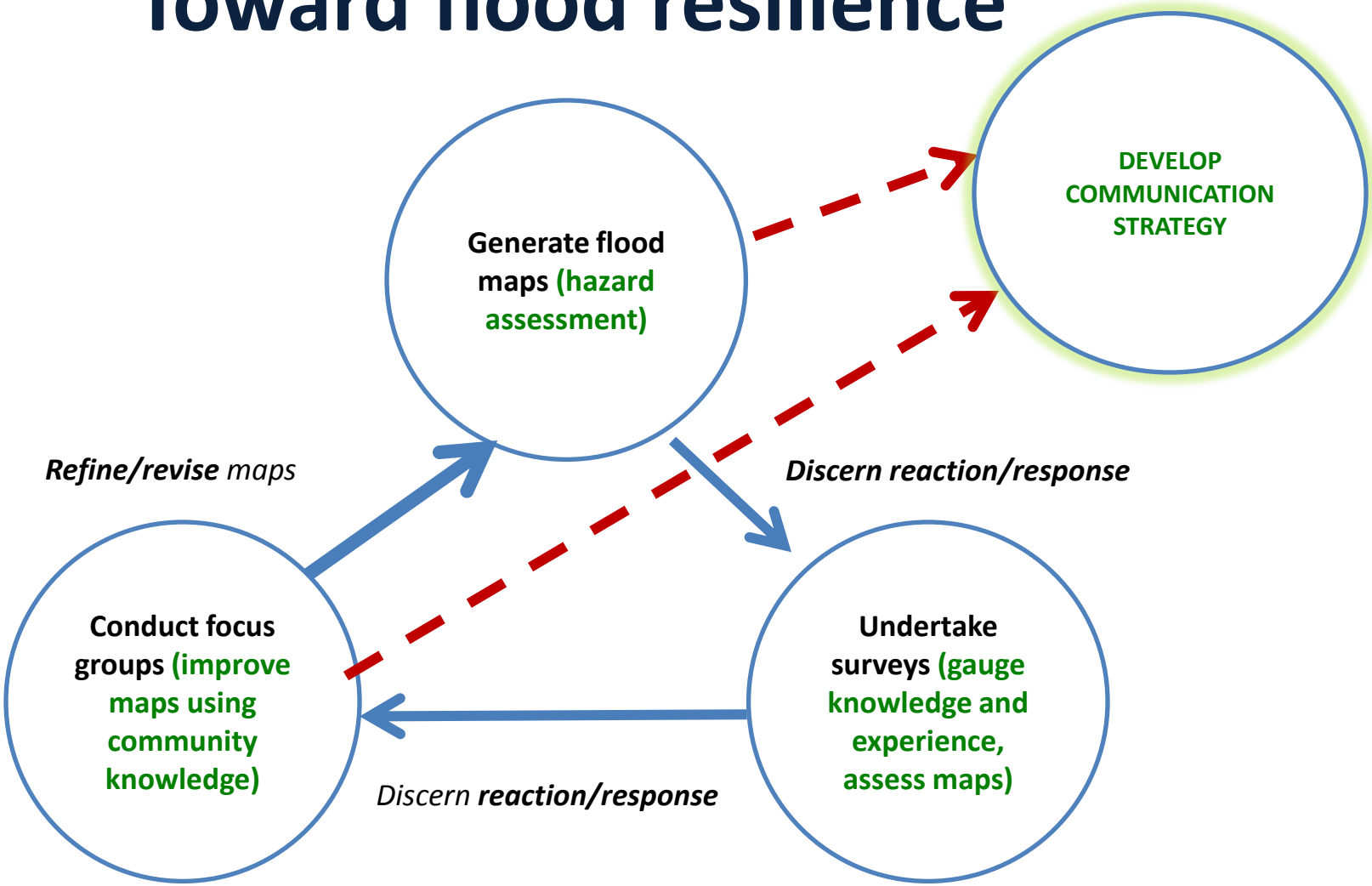
Is sea-level rise a contributing issue?





Balboa Island, Newport Beach, CA

Toward flood resilience



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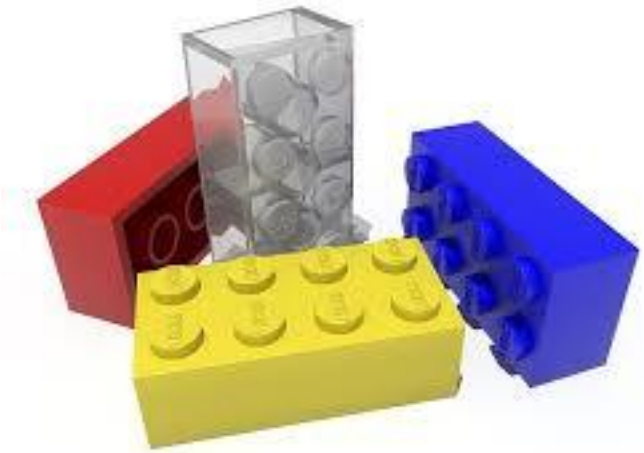
FLOODRISE MODELING EFFORTS

Outline

- Overview of model inputs, outputs, and limitations
- What is different about the UCI model?
- Project goals and status

Flood Mapping a.k.a "Hydraulic Modeling"

- Flood mapping is primarily driven by hydraulic models, which predict the flow of water across complex terrain
- The primary model inputs include a representation of the terrain and a flooding scenario
- Hydraulic modeling is analogous to pouring water on a LEGO set – where the terrain is represented by LEGOS and the flooding scenario is represented by the amount of water poured



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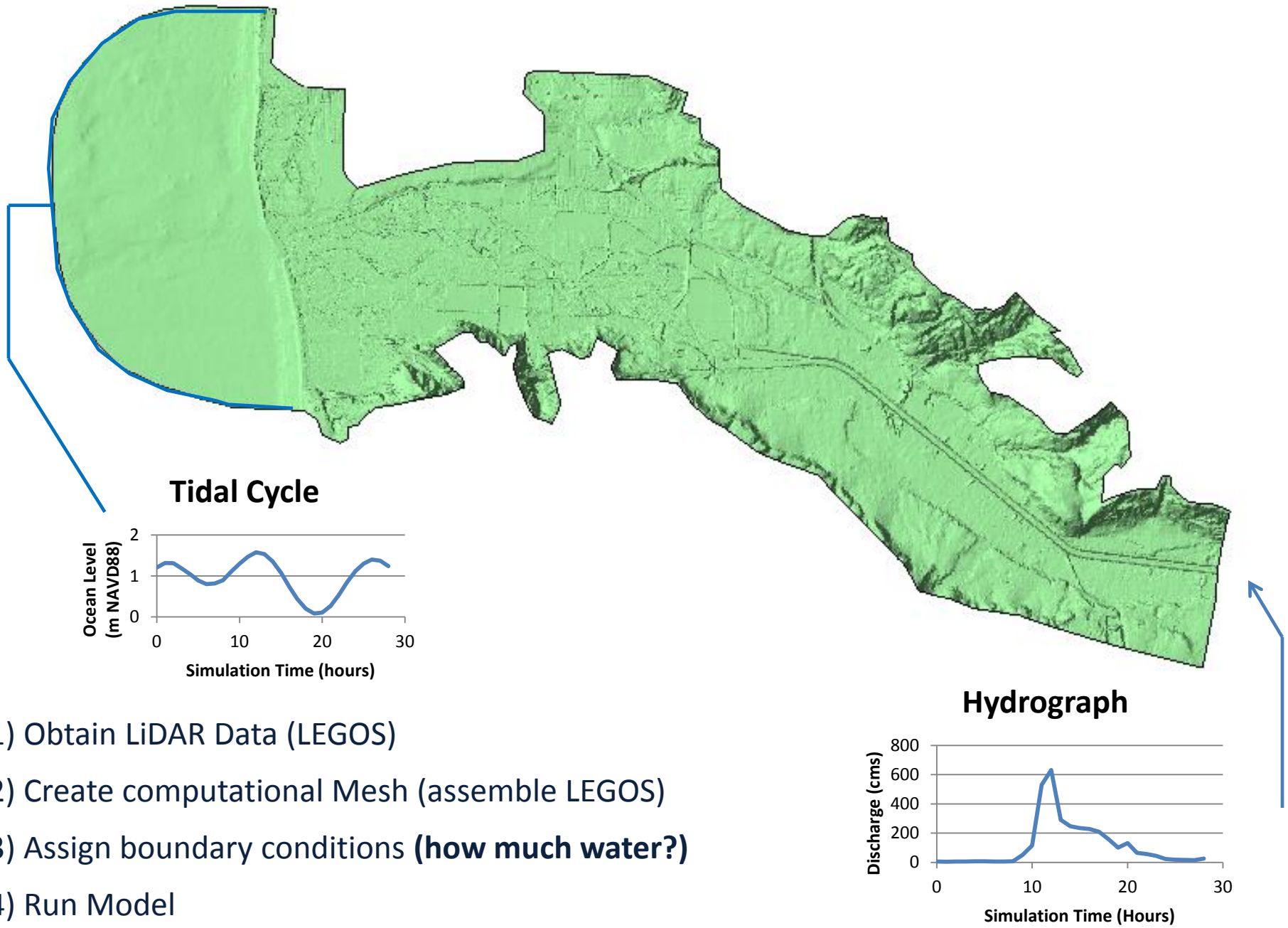

1) Obtain LiDAR Data (LEGOS)

2) Create computational Mesh (assemble LEGOS)

3) Assign boundary conditions **(how much water?)**

4) Run Model

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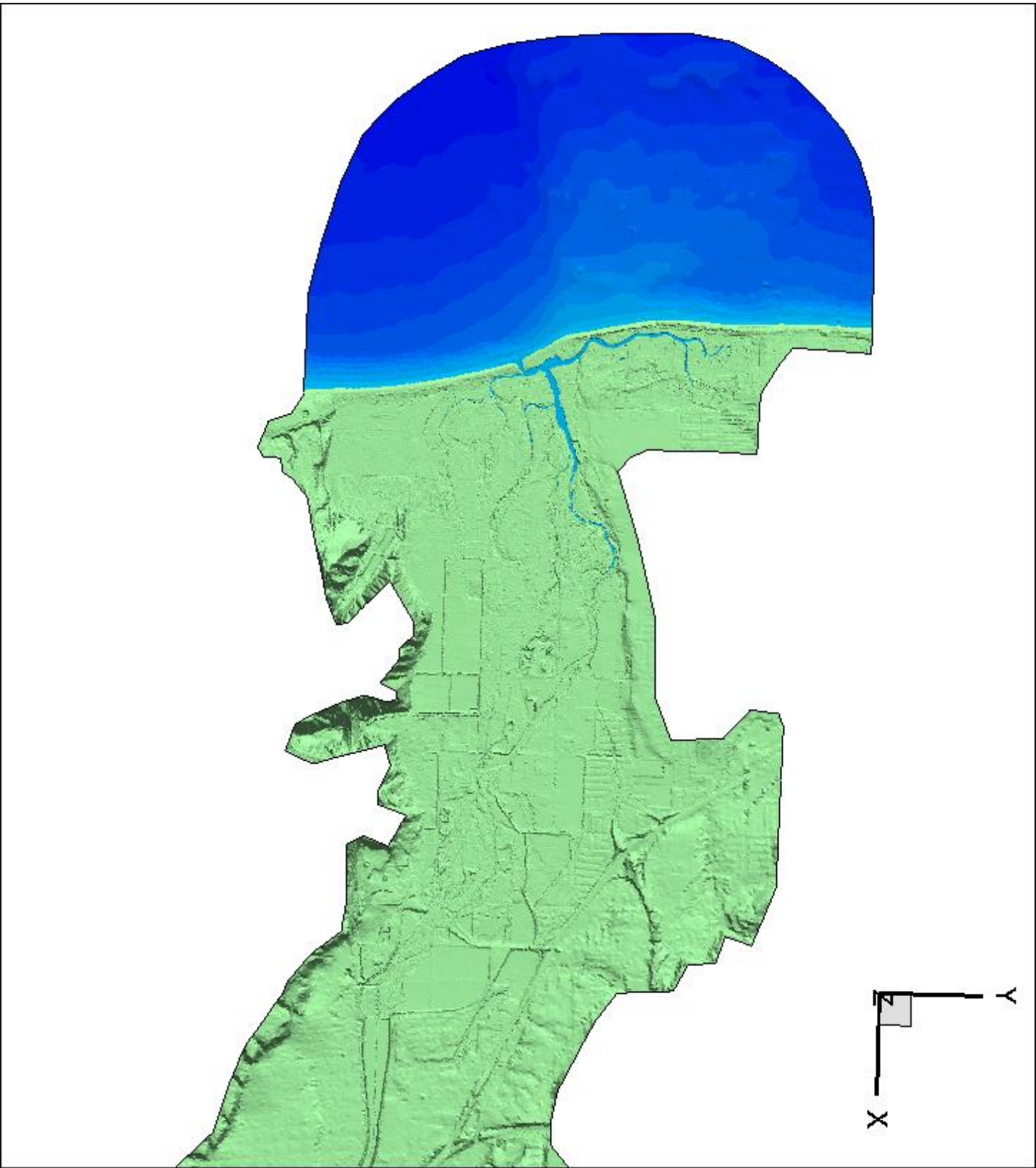
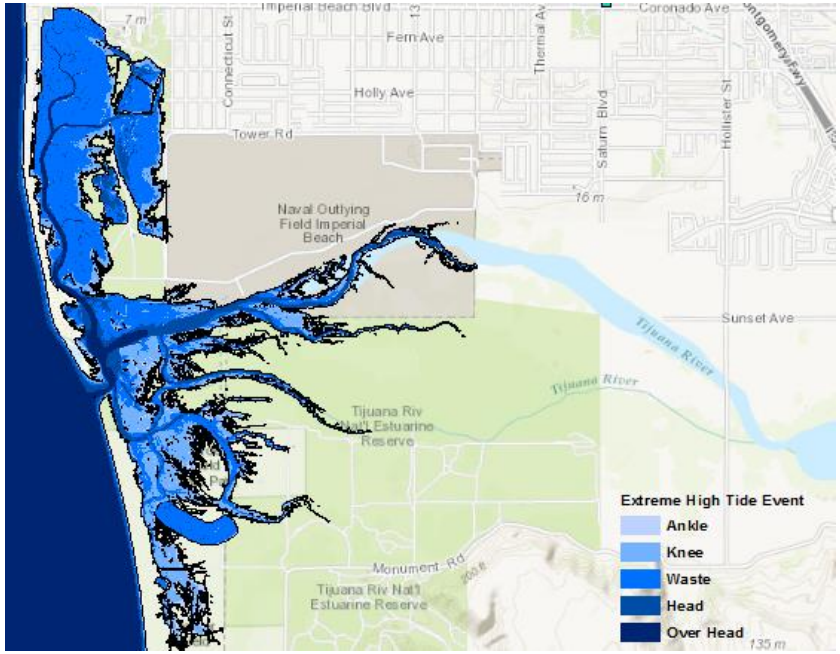
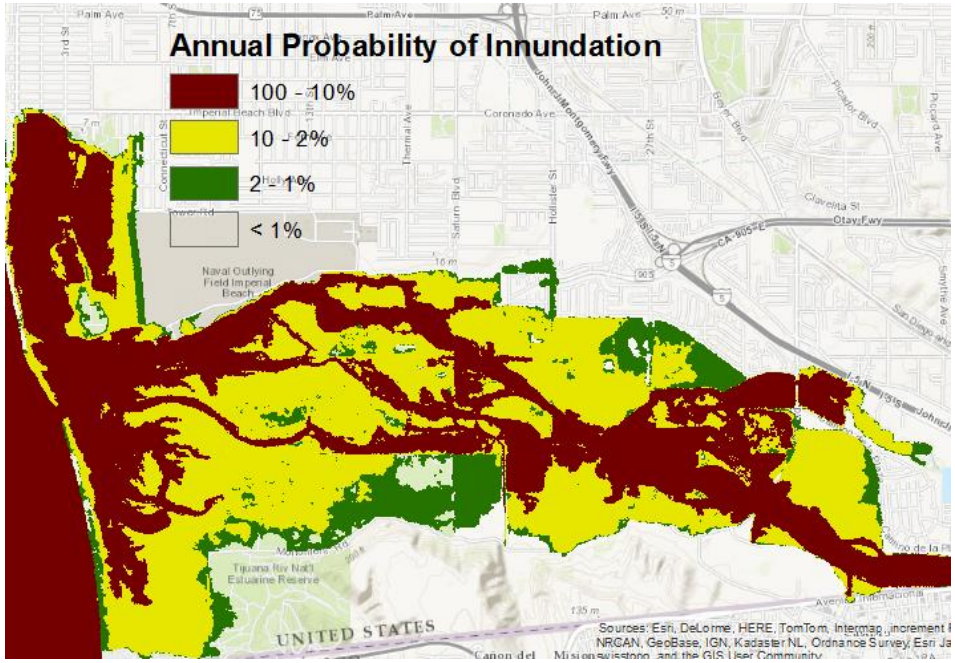


Example of model outputs

- Model directly outputs water depths and velocities, which can be used for contour maps depicting hazards of specific events at the *street level*



- Output can also be processed to generate different products, for example contours of flooding probability



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Model Strengths

- Due to the availability of high-resolution LiDAR, flood hazards can be represented at the street level

- Complex geometries can be represented in the terrain, so a large variety of physical interventions can be modeled

Model Limitations

- There is a high amount of uncertainty in the magnitude of flooding events due to limited data – intrinsic to flood mapping

- Sediment erosion is not accounted for during a simulation – the terrain is "fixed". This is an important caveat when considering sedimentation in channels

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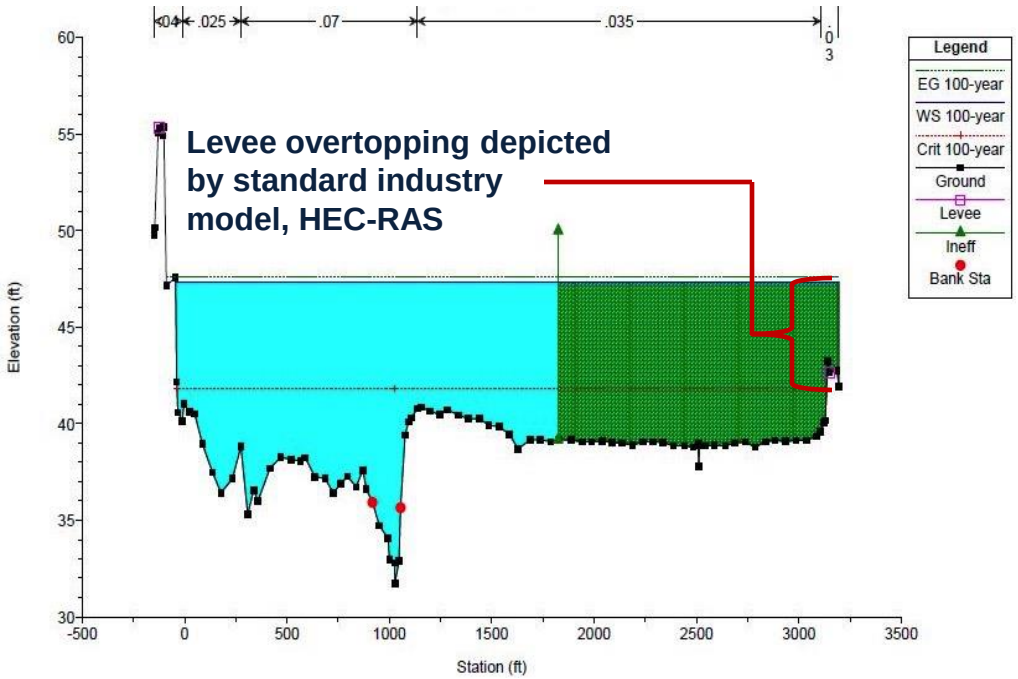
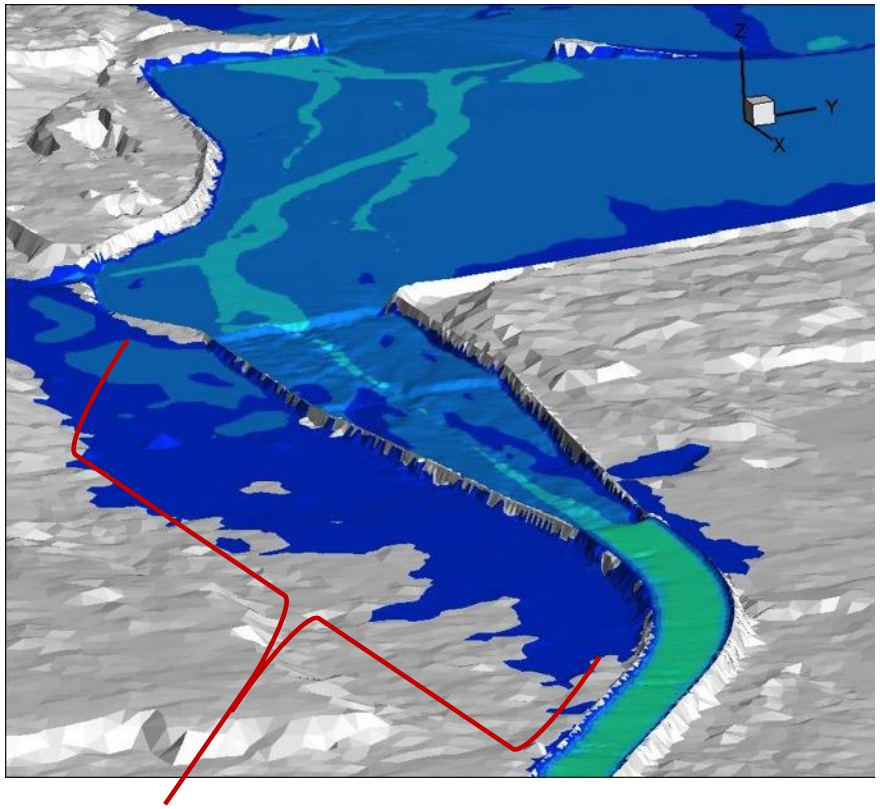
What sets us apart?

#1 - Ability to model complex interaction between river channel and floodplain





Levee overtopping depicted by UCI Model

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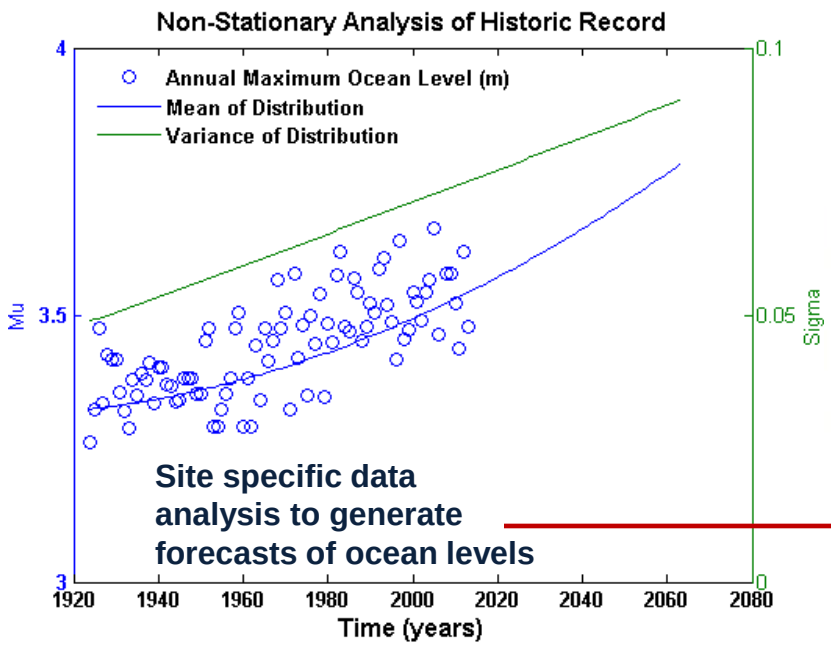
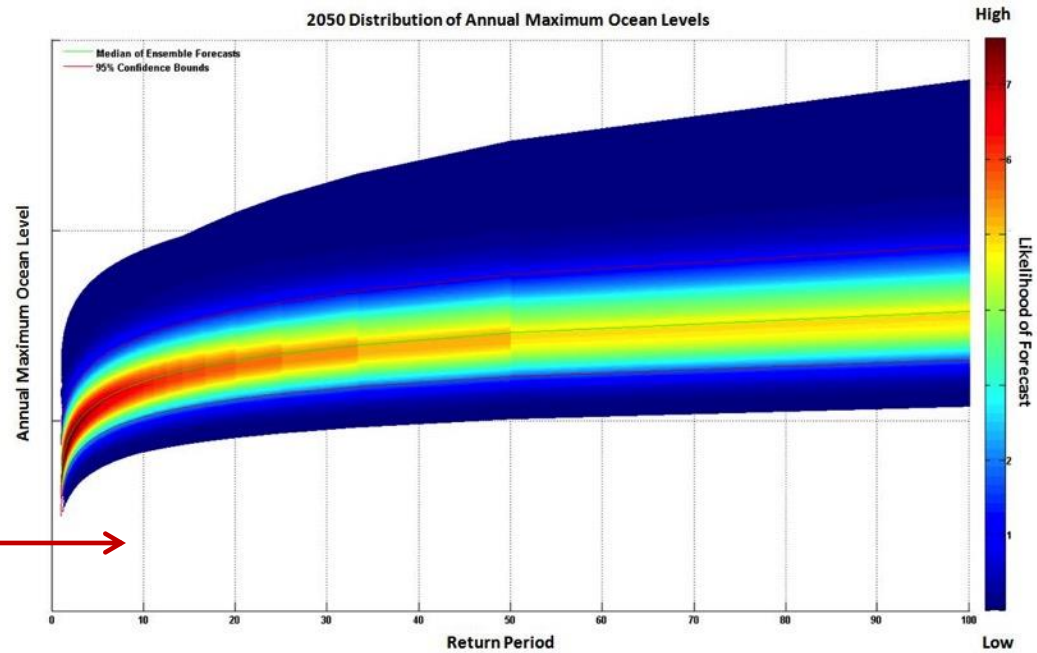
What sets us apart?

#2 - Implementation of novel methods to account for sea level rise in floodplain mapping



Site specific data analysis to generate forecasts of ocean levels



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What sets us apart?

#3 - Direct interaction with stakeholders motivates methods and products – not scientific literature

Focus group meetings intend to answer the following questions for a wide range of interests groups:

1) What scenarios are you most interested in seeing mapped?
2) How do you want those scenarios represented?

Outcomes of these interactions will motivate the methodological research for production of desired, and useful, maps.

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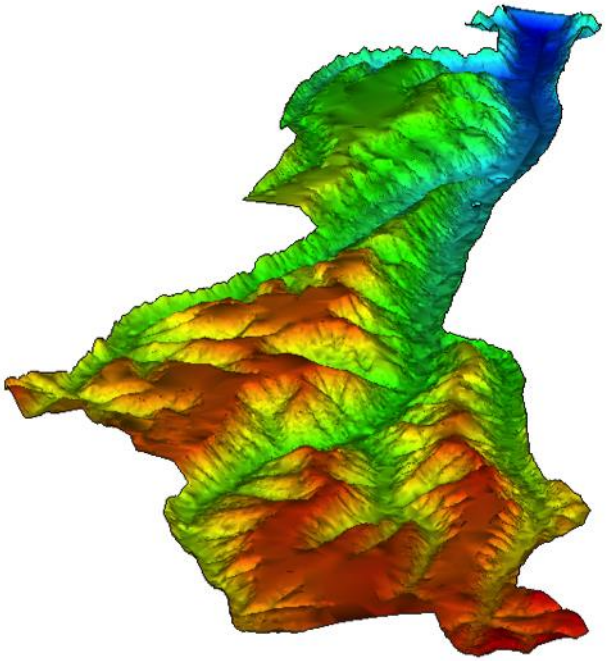
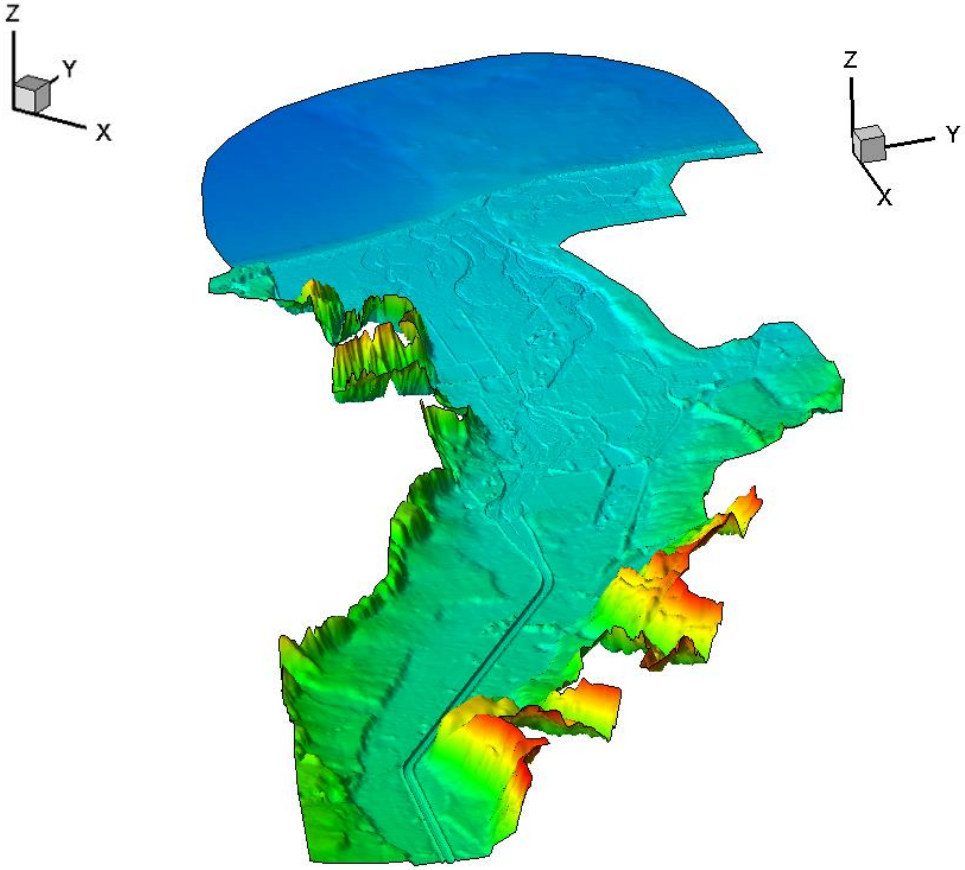
Current Progress

1) Site specific models created for TRV and Los Laureles Catchment





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Next steps

2) Baseline surveys and interviews completed & **FloodRISE team poised for focus group meetings in late 2015**

- Map outputs produced by the modeling team will be presented
- Topics for discussion include:
  - Maps showing potential future flooding due to sea level rise
  - Maps showing changes in estuary habitat due to sea level rise
  - Maps showing impact of hard and soft engineering practices on flood risk

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Questions?

Special thanks to

NSF

UCI Sustainability Initiative

Tijuana River National Estuarine Research Reserve

San Diego State University